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## SOME NOTES ON EELS (*ANGUILLA VULGARIS*) AND EEL-CATCHING IN BEDFORDSHIRE.

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THE River Ouse has for centuries had a reputation for the number of Eels taken from its waters. In the time of King Edgar a rent of 2000 Eels was paid by Stuntney Fen to the monastery of Ely. This payment eventually ceased for six years, and after a trial held at Cambridge the arrears of 12,000 were required to be paid, in addition to the annual rent of 2000 Eels.\*

For the earliest mention of Eels in the county of Bedfordshire we are indebted to the Domesday Survey. Herein is given the Eel value paid as part rent at certain of the water mills as under :—

2 Mills, Tempsford,	paid 120 Eels and 40/-
1 Mill, Little Barford, „	125 „ „ 12/-
2 Mills, Eaton Socon, „	100 „ „ 36/6
2 „ Stanford, „	50 „ „ 29/-
2 „ Clifton, „	150 „ „ 40/-
1 Mill, Putnoe, „	100 „ „ 30/-
1 „ Chainhalle,†	100 „ „ 40/-

\* Dugdale, 'History of Imbanking,' &c., 2nd edit., p. 183.

† The locality of this Manor, in the Half-Hundred of Buchelai, has never been satisfactorily determined. Channel's End, in the parish of Colmworth, is suggested in the 'Victoria County History, Bedfordshire' (vol. i., p. 237), and again Ravensden, in the 'Bedfordshire Historical Records' (vol. i., p. 63). Neither of these writers seems to have taken the *Mill* into considera-

1 Mill,	Goldington,	paid 100 Eels and 30/-
1 „	Cardington,	„ 100 „ „ 40/-
1 „	Willington,	„ 100 „ „ 12/-
4 Mills,	Stotfold,	„ 400 „ „ 80/-
1 Mill,	Bromham,	„ 125 „ „ 20/-
1 „	Great Barford,	„ 80 „ „ 22/-
1 „	Roxton,	„ 260 „ „ 33/-
1 „	Oakley,	„ 200 „ „ 26/-
1 „	Odell,	„ 200 „ „ 36/8
1 „	Bromham,	„ 100 „ „ 40/-
1 „	Harrold,	„ 200 „ „ 36/8

A total of twenty-five mills paying as part rent 2610 Eels.\*

There does not appear to have been any fixed custom as to a part payment of mill rents by Eels, as the other seventy mills in the county referred to in Domesday paid by money value alone. Such rentals varied, from a mill at Sharnbrook rented at 16 pence and another at Keysoe 2/-, to one at Clapham at 40/-. Whether the right of taking Eels in fixed traps was restricted by the holders to certain of their mills only is a moot point, but not an improbable one, as any additional traps fixed above their respective mills would seriously affect their catches.

#### RIVER OUZEL.

*Heath and Reach. Grange Mill.*—One trap, 4 ft. 6 in.  $\times$  13 ft. Average take of Eels per year,  $3\frac{1}{2}$  cwt. Heaviest catch,  $1\frac{1}{2}$  cwt. Largest taken, over 4 lb. First trap on this tributary of the River Ouse. Owing to the chemical refuse flowing into this stream at Leighton Buzzard, the taking of Eels at this mill has considerably depreciated.

*Holcot Mill.*—One trap, 3 ft. 6 in.  $\times$  6 ft. Average take of

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tion, which, judging from its comparatively high rental, must have been one of the most important in the county. Therefore we can reasonably presume the position of this Manor was adjoining the Ouse, and not remote from any important stream, as either of those two localities place it. Even from the part payment of the rent with Eels, it is as practically certain it could not have been either of the above-mentioned localities.

\* It seems probable that there would be some restrictions as to size or weight of Eels in these payments, but nothing is recorded in the Domesday Book.

Eels per year, 28 lb. Largest taken, over 2 lb. First trap on this tributary of the Ouzel, which stream flows through the Woburn Park pools.

#### RIVER IVEL AND ITS TRIBUTARIES.

*Doolittle Mill*\* (*Ampthill*).—One trap, 2 ft.  $\times$  6 ft. Very few Eels are taken. Largest, 2 lb. Trap worked irregularly. First trap on this tributary of the Ivel.

*Campton Mill*.—One trap, 2 ft.  $\times$  6 ft. 6 in. Average take of Eels per year, 1 cwt. Heaviest catch, 15 lb. Largest taken, over 5 lb. Trap worked regularly. First trap on another tributary of the Ivel.

*Shefford Mill*.—Two traps, 3 ft.  $\times$  11 ft. and 7 ft.  $\times$  11 ft. Fixed inside mill and under floor. Average take of Eels per year, 4 cwt. Heaviest catch,  $\frac{3}{4}$  cwt. Largest taken, over 6 lb., others 5 lb., and several over 4 lb. Trap worked regularly. First traps on the main stream of the Ivel.

*Astwick Mill*.—Trap destroyed about 1908. Average take of Eels per year was about  $\frac{1}{2}$  cwt. Formerly the first trap on this tributary of the River Hiz.

*Langford Mill*.—One trap, 6 ft.  $\times$  14 ft. Inside mill. Average take of Eels per year, 2 cwt. Heaviest catch,  $1\frac{1}{2}$  cwt. Largest taken, over 4 lb. Trap worked irregularly. Now the first trap on the Hiz.

*Holme Mill (Biggleswade)*.—One trap, 4 ft. 6 in.  $\times$  13 ft., inside mill; two traps, 4 ft. 6 in.  $\times$  12 ft., outside mill. Average take of Eels per year, 5 cwt. Heaviest catch, 1 cwt. Largest taken, over 4 lb. Trap worked regularly. Four miles of water on the combined stream to Shefford Mill and Langford Mill.

*Biggleswade Mill*.—One trap, 6 ft.  $\times$  13 ft. Inside mill. Average take of Eels per year,  $\frac{3}{4}$  cwt. Heaviest catch, 30 lb. Largest taken, 4 lb. Trap worked irregularly. One mile of water to Holme Mill.

*Sandy Mill*.—Three traps, 3 ft.  $\times$  16 ft. Average take of Eels per year,  $2\frac{1}{2}$  cwt. Heaviest catch, 40 lb. Largest taken, 4 lb. Traps worked regularly. Three miles of water to Biggleswade Mill.

\* The first mill on a stream is oftentimes known as the "Doolittle" Mill. There is another mill of this name near Eaton Bray.

*Southill Pool.*—One trap, 5 ft.  $\times$  7 ft. Average take of Eels per year,  $\frac{1}{2}$  cwt. Heaviest catch, several times over  $\frac{1}{2}$  cwt. Largest taken, 2 lb. Trap worked irregularly. Area of pool upwards of 33 acres.

*Blunham South Mill.*—Two traps, 4 ft.  $\times$  14 ft. 6 in. Average take of Eels per year, 4 cwt. Heaviest catch,  $1\frac{1}{2}$  cwt. Largest taken, over 5 lb.; three weighing 15 lb. taken in one night, March, 1912. Traps worked regularly, March to October. One and a half miles of water to Sandy Mill, and also stream from Southill and Warden pools.

*Blunham Mill.*—Two traps, 4 ft.  $\times$  16 ft. Average take of Eels per year, 3 cwt. Heaviest catch, 62 lb. Largest taken, 3 lb. Traps worked regularly. One mile of water to South Mill.

*Tempsford Mill.*—One trap, 4 ft.  $\times$  16 ft. Average take of Eels per year, 2 cwt. Heaviest catch,  $1\frac{1}{4}$  cwt. Largest taken, four weighing 16 lb.; caught December, 1912. Trap worked regularly. One mile of water to Blunham Mill.

#### RIVER OUSE.

*Turvey Mill.*—Three traps, 4 ft.  $\times$  16 ft. Average take of Eels per year, 5 cwt. Heaviest catch, 1 cwt. Largest taken, 5 lb., and several of 3 lb. and 4 lb. Traps worked regularly. Three miles of water to Lavendon Mill, in Buckinghamshire.

*Harrold Mill.*—One trap, 11 ft.  $\times$  27 ft. Average take of Eels per year,  $1\frac{1}{2}$  cwt. Largest taken, over 4 lb. Traps worked irregularly. Three and a quarter miles of water to Turvey Mill.

*Odell Mill.*—Two traps, 7 ft. 3 in.  $\times$  17 ft., 4 ft. 3 in.  $\times$  13 ft. Average take of Eels per year, 1 cwt. Largest Eels taken, 3 lb. to 4 lb. Traps worked irregularly. One and three-quarter miles of water to Harrold Mill.

*Sharnbrook Mill.*—Traps dismantled about 1890.

*Milton Mill.*—Three traps; two 5 ft.  $\times$  16 ft., one 3 ft.  $\times$  16 ft. Average take of Eels per year, 7 cwt. Heaviest catch,  $4\frac{1}{2}$  cwt., in one night in 1909. Largest taken in fifty years,  $4\frac{1}{2}$  lb. Traps worked regularly. Eight and a quarter miles of water to Odell Mill.

*Oakley Sluice.*—Three funnel traps, 4 ft.  $\times$  15 ft. Average take of Eels per year, 3 cwt. Heaviest catch, 300, about 1890. Largest taken,  $6\frac{1}{2}$  lb. in October about 1890. Traps worked



irregularly. Four and three-quarter miles of water to Milton Mill.

*Bromham Mill.*—One trap, 4 ft.  $\times$  16 ft., inside mill and alongside wheel. Average take of Eels per year, 6 cwt. Heaviest catch,  $1\frac{1}{2}$  cwt. in one night; 7 cwt. in a month about 1890. Largest taken,  $6\frac{1}{4}$  lb. Trap worked regularly. Four and three-quarter miles of water to Oakley Sluice.

*Kempston Mill.*—One trap, 8 ft.  $\times$  15 ft. Average take of Eels per year, 1 cwt. Largest taken over 6 lb. Trap worked irregularly. Two and a half miles of water to Bromham Mill.

*Duck Mill, Bedford.*—Demolished and traps removed, 1890.

*Cardington Mill.*—Three traps, 4 ft.  $\times$  15 ft. Average take of Eels per year, 2 cwt. Heaviest catch, 3 cwt. in twenty-four hours, about 1909. Largest taken, 4 lb. Traps worked irregularly. Five miles of water to Kempston Mill. The "New Cut" would no doubt take the greater proportion of Eels from above Bedford direct to Castle Mill.

*Castle Mill (Goldington).*—Two traps, 9 ft.  $\times$  15 ft. and 5 ft.  $\times$  42 ft. Average take of Eels per year, 8 cwt. Heaviest catch, 2 cwt., about thirty years ago. Largest taken, under 4 lb. Traps worked regularly. Two miles of water between this and Cardington Mill, and in addition, that proportion of the Eel supply *viâ* the "New Cut" from Kempston Mill.

*Roxton Sluice.*—One funnel trap, 5 ft.  $\times$  12 ft. Trap broken and not used for several years past. One of 9 lb. is recorded from information given to me by the late Mr. Martin George, of Tempsford, taken at Roxton Sluice about 1880.\* I have since heard what was probably the same Eel spoken of as weighing 7 lb.

*Eaton Socon Mill.*—Four funnel traps. Three 4 ft.  $\times$  16 ft., one 4 ft.  $\times$  12 ft. Average take of Eels per year, 15 cwt. Heaviest catch, 10 cwt. in three days, about 1909. Average weight,  $\frac{3}{4}$  lb. to 1 lb. Largest taken, 4 lb. 10 oz., length 37 in., in August, 1909.† If traps were worked regularly, an average of 1 ton per year could be taken. Ten miles of water to Castle Mill.

There are fourteen additional water-mills in the county at the present day where Eel-traps are not fixed.

\* 'Victoria County History, Bedfordshire,' vol. i., p. 101.

† 'Bedfordshire Times and Independent,' August 6th, 1909.

The measurements of the traps are the extreme sizes taken from inside the sluice-gates. The average weight of Eels is taken from a period of the last ten years. The records of the heaviest catches taken in one night and the largest Eels obtained is from information generally.

The weight of Eels taken at the respective traps is in a few instances approximate only; the quantity taken at any particular mill is dependent upon how regularly the traps are worked, and in relation also to the number of Eels taken in other traps above stream. But the general total would not be affected. This shows an annual take within this county of 3 ton 18 cwt., which, taken at an average weight of  $\frac{1}{2}$  lb. each, would number nearly 17,500 Eels. At the local market price of 6d. per lb. the total catch would be practically £220 value, or even more if the London trade were supplied.

Drainage of the fens and the watershed of the Ouse generally must have accounted for a considerable decrease of Eels, and further no fish could be subjected to greater persecution by their capture, and it is not surprising to find that it would be impossible for several of the mills mentioned in the Domesday Book to take at the present time even as many as formerly paid for part rent.

Eels working down the Ouse from above Bedfordshire have to pass eleven traps within this county alone, or, again, nine traps from the upper reaches of the Ivel, any of which traps are practically capable of taking every Eel on migration.

But fortunately for the preservation of the Eel from extermination, the mill traps are often worked but intermittently, as when the miller's trade is good and the water supply limited it is oftentimes all required for motive power and none can be spared to pass through the sluice-gates for Eel-catching, and so at many of the traps they oftentimes escape capture.

The taking of Eels is principally by means of fixed traps, traps that are probably very little different in their construction from those of Norman times.\* A trap consists of an upward sloping

\* 'Victoria County History, Bedfordshire,' vol. i., p. 212, says: "The Eels so often found in Domesday as forming a portion of the mill's render came of course from the mill-pool." This is obviously incorrect, the Eels being taken from the stream above the mill.

grid with an upright end fixed between the sluice-walls, and three to four feet from the mouth of the sluice-gate. When the gate is slightly raised, the power of the higher stream forces the water into the trap, and any Eels that enter are carried upwards to the head of trap; here they lie in a wooden trough protected from the force of the water, and if the traps are so constructed, this trough is continued through the sluice-wall to an Eel-well built in the bank of the stream, where, with a continuous stream of water passing through, the Eels can remain until they are marketed, although in many such wells they are liable to a fungoid growth if left for many weeks; hence many Eel catchers prefer to keep them in perforated wooden boxes in the open river.

Funnel traps are used at Eaton Socon, Oakley, and formerly at Roxton. These traps have a wired, funnel-shaped covered-in entrance that quickly converges into a boxed-in trough, along which the Eels pass to the transverse trough leading to the Eel-well. The objection to these traps is partly their instability, but more particularly their liability to get quickly choked up with weeds, sticks, and other refuse, and the difficulty of freeing them again in comparison with the open traps.

Other means of taking Eels are with the independent basket traps, which are usually about three feet long and constructed of osiers; these are placed on the bottom of the stream, and of course have to be baited. A number also used to be taken with night-lines. But both these methods are far less practised now than formerly. Some few are secured by angling, usually with a hook, but occasionally by a needle-threaded worm.

Eel-gleving, once a common method of taking Eels, is now almost unknown. A gleve is a four- or five-bladed spear attached to a pole some 15 ft. long, and used by continually thrusting it into the bed of the stream wherever Eels were considered likely to lie. Any Eel struck by the gleve is forced up by the blow between the blades and held securely in that position by the rows of barbs along each edge of the blades. The shallower streams with a more or less even bottom are most suited for their capture, hence gleving was far more frequently practised on the Ivel and other smaller streams and backwaters than on the Ouse itself.

Of the life-history of the Eel little can be gleaned from those

persons in charge of the traps, and less is credited by them of their migration and breeding in the open seas. Yet, strange to say, these countryfolk can seldom offer any explanation for their movements down the river, or again for the young passing up stream. That they breed in the mud is usually taken for granted, and some will go so far as to maintain that they have seen the young taken from a ripe female.

The most favourable time of the year for the adult migration of Eels towards the sea is from mid-July to mid-October. There is also oftentimes a considerable spring movement about April, when good catches are frequently made, and by some the proportion of large Eels is considered greater at that time of the year, but others are of the opinion that the majority of larger ones come late in the autumn. Erratic movements occur during almost any month of the year, and occasionally heavy catches are made, even in the winter months, during a spell of mild weather, as for instance, some  $2\frac{1}{2}$  cwt. were taken at Eaton Socon traps in December, 1911.

Some few Eels are occasionally taken during the daytime, more particularly if the traps are inside the buildings or covered in, and thick water is running at the time. When taken during the day it is a most invariable sign for a heavy catch to follow at night. As a rule Eels start to "run" about two hours after sunset, and continue "running" until midnight, after which hour very few pass into the traps, as I have frequently satisfied myself from personal observation, throughout the dark hours of the early morning. Neither can this limited movement be accounted for by all the Eels in any section of the river having been taken owing to the usual short distances between the traps, as where much longer reaches of water occur the results are the same. The darkest nights, with thick water and wind south to west, are most favourable to migration, any moon considerably checking their progress. After a thunderstorm the greatest catches are usually made, and if such stormy weather or thick water continues, their migrations will be prolonged for several successive nights. Frosty nights immediately check their running, and no Eels are taken in snow water.

Water-weeds that have been cut and floated down the stream and allowed to accumulate across the river above the trap



gates are an attractive cover for Eels, and help the catches considerably.

Many persons affirm that Eels travel short distances over-land, but I have never had satisfactory proof of this. It is well known that Eels kept in close confinement will free themselves if possible, and then endeavour to find their natural element again, but I have never known them leave their natural haunts or any large area of water for such a purpose. In 1897, when Southill Lake was temporarily drained, the head-keeper, at my instigation, removed a number of Eels and placed them in a large pond which had no stream flowing out of it. Some of these Eels were captured for many successive years, showing annual increase in weight, and practically every one was eventually accounted for.

The young Eels enter the River Ouse at the Wash in April, and reach this county in the early summer months, having covered a distance of some sixty-four miles, overcoming all the difficulties of weirs, sluice-gates, and other obstacles by their indefatigable progress. By this time they have usually attained a length of 4 in. to 6 in.\* The smallest, of which I have a note, being  $3\frac{3}{8}$  in., taken at Blunham Old Mill sluice-gates, July 24th, 1912, with many others of a larger size.

The migratory Eels taken at the traps usually weigh from 6 oz. to 1 lb., and a few up to 2 lb. in weight; possibly smaller Eels may descend, but the openings between the bars of the traps would usually allow such to pass through and escape. Eels taken over 2 lb. in weight are the exception, and although many instances are given under the heading of those taken at the traps of fish over 6 lb. in weight, I have so far not been able to properly authenticate any record of an Eel being obtained even of 5 lb. in weight. Large Eels are said to be very coarse eating.

Of the rate of migration of our Eels down the river very little is known, but such progress is evidently slow, as their

\* "I have noticed them in the latter part of the summer at the side of the Ouse near Bromham as small, thread-like specimens of about an inch or more in length" ('Victoria County History, Bedfordshire,' vol. i., p. 101). Evidently a misstatement of facts, as the Elvers do not enter the Ouse from the sea until at least nearly three inches long.

movements are so intermittent and impeded, and, as already stated, restricted to a few hours in the night. From the upper reaches of the Ouse in Bedfordshire Eels would have a journey of some one hundred miles before reaching the Wash, and under all circumstances it seems probable that such a journey would take at least a month or more to complete.

The number of years that Eels remain in these waters before returning to the sea seem to vary considerably, and it is difficult to satisfactorily account for this retarded migration.

The largest Eels taken are usually females, the females growing more rapidly and attaining a larger size than males.

There is a considerable variation in the colour of the migratory silver-bellied Eels; they range from pale green to black and light yellow to dark brown. By many Eel-trappers these are considered two separate species, the former being termed "Black Eel," and these are said to be generally of large size. Then, again, the undeveloped and at present non-migratory yellow Eel is termed the "Yellow-bellied Eel" and "Mud Eel"; these are considered a smaller species. Those Eels that have developed the enlarged mouth that is attained previous to their final transformation are spoken of as "Frog-faced Eels" and "Bull-headed Eels."

There is a strong belief that Eels feed and enter into any carcase lying in the water and will be seen to leave such bodies when disturbed. Hence we occasionally hear this ignorant and ghastly story applied to drowned persons.

There is no doubt that the Eel from a commercial standpoint is worthy of more consideration, and the present decreasing supply obtained could be very much increased by reasonable protection. There should be a close season for them at the sluice traps during part of the migration period, and some means devised of helping the young Eels to overcome more easily these difficulties of access to the upper reaches of the river.

## ON THE LOCATION OF THE SACCULUS AND ITS CONTAINED OTOLITHS IN FISHES.

BY COLONEL C. E. SHEPHERD (Indian Army).

(Concluded from p. 109.)

### OSTARIOPHYSI.

In this suborder the families of the *Characinidæ*, the *Gymnotidæ*, the *Cyprinidæ*, and the *Aspredinidæ* have the asteriscus as the largest otolith. In the families of the *Siluridæ* and the *Loricariidæ* the lapillus is the largest. In all the families the sagitta is rod-like, or perhaps would be better described as like a splinter.

### CHARACINIDÆ.

The sacculus in this family is thoroughly embedded in a bony cavity which has to be carefully split open to expose it; it is found completely filling the cavity. In *Erythrinus salmoneus* (fig. II., 5) the position of the sacculus is indicated from the outside by two polished-looking little excrescences of the basi-occiput. *Macrodon trahira* (the "Haimara" of British Guiana) has similar excrescences, the bone of them being very thin (fig. II., 6). *Myletes setiger* (the "Paca" of British Guiana) does not show these excrescences. The lapillus in this family is well developed, and lies in a special cavity at the side of the skull, but not showing palpably on the outside. *Leporinus arcus* and *L. maculatus* show their sagittæ through the thin bone underlying them, which, however, lies flat and does not stand out at all.

### GYMNOTIDÆ.

Of this family only two small specimens have been available for examination—one a *Eigenmanuia virescens*, the other a *Sternopygus macrurus*; they were too small to allow of any external indications being noted. The asterisci were found to be the largest of the otoliths.

## CYPRINIDÆ.

This, the Carp family, like the latter two families, has the sacculus embedded in a bony cavity, and the conditions are very similar, except that with the *Cyprinidæ* there is no external evidence of the sacculus, nor does the recess in which the lapillus rests show prominently on the outside.\*

## SILURIDÆ (the Cat fishes).

This family also has its sacculus embedded in bone, as have the last three noted above. The lapillus, however, is the largest otolith, and in some of the *Arius*† species it is a very large stone, and consequently has a very large recess in the inside of the skull to accommodate it. This stone can be lifted out of its recess without much or any cutting away of bone. Externally the situation of the lapillus can be judged by a smooth swelling prominence of bone over it.

## LORICARIIDÆ.

*Plecostomus bicirrhosus* (called the "Sea Hussar" in Demerara; it is, however, a freshwater fish) has the ear labyrinth lying open in a double cavity at the side of the skull quite different to the boxed-in condition in the *Siluridæ*. As with them the lapillus is the largest otolith (fig. II., 7); the difference in size was made up by the more solid build of the lapillus, which does not come out in the photograph.

## ASPREDINIDÆ.

In *Aspredo sicuephorus* the bone had to be cut away to get out the sacculus. The asteriscus is the largest of the otoliths.

## APODES.

In *Anguilla vulgaris* (the Eel) the position of the otoliths is revealed externally by two very slight swellings of thin bone. *Myrus vulgaris*, a Mediterranean Eel, has the sacculus in a cradle-like cavity, from which it could be lifted out. The lapillus in this fish is not quite like the usual shape of this stone; it has

\* For illustrations of the asterisci of some Carps, see 'Zoologist,' 1910, p. 3, figs. 20, 21, 22, 23; see also 'Zoologist,' 1910, p. 293, fig. 16. The splinter-like sagitta is faintly visible.

† See 'Zoologist,' 1910, p. 293, fig. 19, and p. 294, pl. ii., fig. 4.



also a slight hook at its extremity. In *Conger vulgaris* (the Conger) some thin but not transparent bone of the basi-occiput shows the site of the sacculus. The sagittæ are large.

#### ESOCIDÆ.

*Esox lucius* (the Pike) has no external indication of the site of the sacculus. This is contained in an open pocket from which it could be easily lifted out; it shows no distinct lagena, but the asteriscus can be seen through the tissues of the sacculus; the sagitta also shows through.

#### SCOPELIDÆ.

In *Scopelus punctatus* the sagittæ lie in two ovoid pockets that show on the outside; the thin bone under them permits of their being seen.

#### CYPRINODONTIDÆ.

In *Haplochilus playfairii* the pockets for the sacculus are at the side of the head, and two excrescences on the under side of the skull show their situation. *Anableps tetraphthalmus* (the "Four-eyes" of British Guiana) has no outside indication of the site of the sacculus; it rests in an open cavity at the outer side of the brain chamber.

#### FIERASFERIDÆ.

The comparatively large solid sagittæ of *Fierasfer acus*, a Mediterranean fish, show clearly through the transparent bone underlying them.

#### GASTROSTEIDÆ.

The "Sticklebacks" have no outside indication of the position of the sacculus apparent. As may be surmised, the sagittæ are very minute.

#### CENTRISCIDÆ.

In *Centriscus scolopax* (the "Trumpet Fish" or "Bellows Fish") there is no external evidence of the site of the sacculus. It lies loose on the floor of the skull, with no apparent special cavity for it.

#### SYNGNATHIDÆ.

*Syngnathus acus* (the "Pipe Fish") has no external indication of the site of the sacculus.

## SCOMBRESOCIDÆ.

*Exocoetus pæcilepturus* (the "Flying Fish") shows the position of the sacculus by two distinct excrescences of the base of the skull. The sagittæ are large for the size of the fish. *Belone annulata* (the "Garpike") has two elongated bosses of thin bone, not so much under the basi-occiput but at the under side of the skull, that cover the sacculi and show their position. The sagittæ are small for the size of the fish.

## AMMODYTIDÆ.

*Ammodytes lanceolatus* (the Sand Eel or Launce) shows the site of the sagittæ by a piece of thin bone underlying them; this does not stand out, however, from the skull. The sagittæ are small.

## ANTHERINIDÆ.

In *Atherina hepsetus*, a Mediterranean fish, the bone of the base of the skull is very transparent. The sagittæ could be seen quite plainly *in situ*. In *Atherinichthys bonariense* (called the "Sea Pajerrey" at Buenos Aires) the site of the sacculus is indicated by two elongated prominences of thin bone, but not transparent enough to show the stones. In *A. argentinense* (the "Freshwater Pajerrey") the thin bone over the sacculus is not markedly prominent, neither is it transparent enough to show the stones, which are of but moderate size for the size of the fish. The sacculus part holding the sagitta is in an open pocket; the stone could be lifted out through the open top. The lagena end of the sacculus is, however, covered with bone which had to be cut away to get out the asteriscus.

## MUGILIDÆ.

The sacculus of *Mugil braziliensis* (the "Queeriman" of Demerara, British Guiana) rests in a bony pocket that is open at the top. The lagena is long, and runs back at the end of the pocket into a burrow of its own in the basi-occiput. *M. capito* (the Grey Mullet) has two strong bony prominences on the basi-occiput that continue upwards round the side. This upward portion is what lies more immediately under the site of the sacculus, which is placed in a long bony pocket; the lagena is a very decided prolongation of the sacculus, and holds a fairly

large asteriscus of crescentic shape. The sacculus pocket is open at the top, but bone has to be cut away to free the lagena. In this family the sagitta is of fair size and very much curved.

#### POLYNEMIDÆ.

In *Polynemus tetradactylus* (the "Mangoe Fish" of Calcutta, where it is also called "Tapsi machli," adopting one of the native names) the site of the sacculus is indicated exteriorly by a slight swelling of the basi-occiput bone. The pocket containing the sacculus is open at the top; the sacculus could have been easily lifted out but for the lagena portion, which runs back into a bony burrow encasing it completely, and requiring to be cut away to extract it. The otoliths from the right half of the head are illustrated (fig. I., 4).

#### SPHYRÆNIDÆ.

*Sphyræna vulgaris* (the "Barracuda") has the sacculus lying in a groove in the bone of the skull, which is open at the upper end, a little bone, however, has to be cut away to free the sacculus altogether. The otoliths in this fish lie more parallel to, *i. e.* with less divergence from the middle line of the fish at their forward end, than is the case with so many other fishes.

#### STROMATEIDÆ.

*Stromateus niger* (the Pomfret" of India) does not show externally the situation of the sacculus; inside, the sacculus is in a pocket open at the top, but cased in with bone at the sides. The lapillus has a marked recess in the skull for itself.

#### OPHIOCEPHALIDÆ.

In *Ophiocephalus punctatus* the situation of the sacculi is well marked by two excrescences on the under side of the basi-occiput, which stand well out.

#### ANABANTIDÆ.

In *Anabas scandens* (the "Climbing Perch" of India) the sacculi are located in two prominent excrescences, which, when the branchial arches are removed and the skull reversed, show remarkably clearly. The lagena is a long prolongation of the sacculus; it has a little pocket to itself. The sagittæ are fairly large and solid for the size of the fish (fig. II., 2).

## GADIDÆ.

In this family of the Cod and its congeners the sagittæ are large, and their location is shown from the outside by a swelling of the basi-occiput, and in some cases, as in *Gadus merlangus* (the Whiting) and *G. minutus* (the "Power"), by the thin bone covering the stones allowing the opaque white bodies to be seen. In some the sagitta can be easily picked up from the inside with forceps; this is the case with *Merluaias vulgaris* (the Hake); in others, a very little clearing away of bone enables the sagitta to be got out. This is so with *G. merlangus* and with *Molva elongata*, a Mediterranean relative of the "Ling." In *Uraleptus maraldi*, another Mediterranean fish, on the contrary, the sacculus is completely embedded in bone, its place shown exteriorly by a large swelling of the basi-occiput, which is out of proportion to the size of the sagitta when this is got out.

## BERYCIDÆ.

*Beryx splendens* shows its sagittæ through the thin bone that underlies them below the skull. These otoliths are large.\*

## PEMPHERIDÆ.

The sagitta in *Pempheris russellii* is comparatively large.

## CENTRARCHIDÆ.

In *Kuhlia marginata*, a fish from New Guinea, the site of the sacculus is marked by a piece of thin bone, slightly elevated, that shows the whole length of the sagitta through it on each side, looking like grains of barley in shape. The sacculus is embedded in a bony pocket requiring to be cut away. The sagitta is a moderate size; the asteriscus is, however, very small in size, even for this usually small stone.

## LOBOTIDÆ.

In *Lobotes colonorum* the sacculus lies in a strong bony pocket requiring to be much cut away to free it.

## PERCIDÆ.

In *Acerina cernua* (the Ruff, Pope, or Jack Ruff) the two well-defined pockets holding the sagittæ are covered with thin

\* See illustration, 'Zoologist,' 1910, p. 293, pl. i., 9.



flexible bone, which allows the stones to be distinctly visible from the outside. Inside, the pockets are open at the top. In *Perca fluviatilis* (the Perch) the site of the otoliths is very apparent: two bulbous swellings, one each side of the basi-occiput, mark it unmistakably. The sagitta, large for the size of the fish, is well embedded in a bony pocket and the lagena well defined.

#### SERRANIDÆ.

*Serranus gigas* (the "Dusky Perch") (Couch) has its sacculus in a long deep pocket, with room enough in it to allow the sagitta to be freely moved backwards and forwards in it. In *S. cabrilla* (the Comber) and *S. scriba*, a Mediterranean fish, smaller members of the family, the sacculus is more boxed in; the sagitta has not so much room for motion. In *Apogon rex mullorum* the thin bone below the sacculi permits the sagittæ to be clearly located; they are large for the size of the fish. *Ambassis urotænia* has two large, almost hemispherical, protuberances of thin bone under the sacculi; the opaque bodies of the sagittæ show through. These stones are large for the size of the fish.

#### PSEUDOCROMIDIDÆ.

In *Lopholatilus chamæleonticeps* (the "Tile Fish" of the North Atlantic Ocean) the sacculus is held in a bony pocket open at the top, through which the sacculus could be seen projecting, but bone had to be cut away to extract the otoliths.\*

#### SCIÆNIDÆ.

Amongst these fishes the sagitta is large, and consequently a palpable swelling of the basi-occiput shows the position of the sacculi and their enclosed stones. *Umbrina cirrhosa* (the Umbrina) (Couch) has a large pocket for the sacculus well open at the top, the whole of the ear labyrinth on each side was picked out at once, no cutting away of bone being found necessary, the semicircular canals only needed to be cut across. In *Corvina nigra*, a Mediterranean fish, the sacculus is in a big roomy pocket open along the top but closed at the ends. The lagena stretches well away at its extremity of the sacculus, and has a roomy pocket to itself. In *Nebris microps* (the "Butterfish" of Deme-

\* For illustration, see 'Zoologist,' 1910, p. 294, pl. ii., 1.

rara) the position of the sagittæ is well defined from the outside, the bone under them being thin. They are large and inclined at a sharp angle; their pointed ends upward, and the other end,

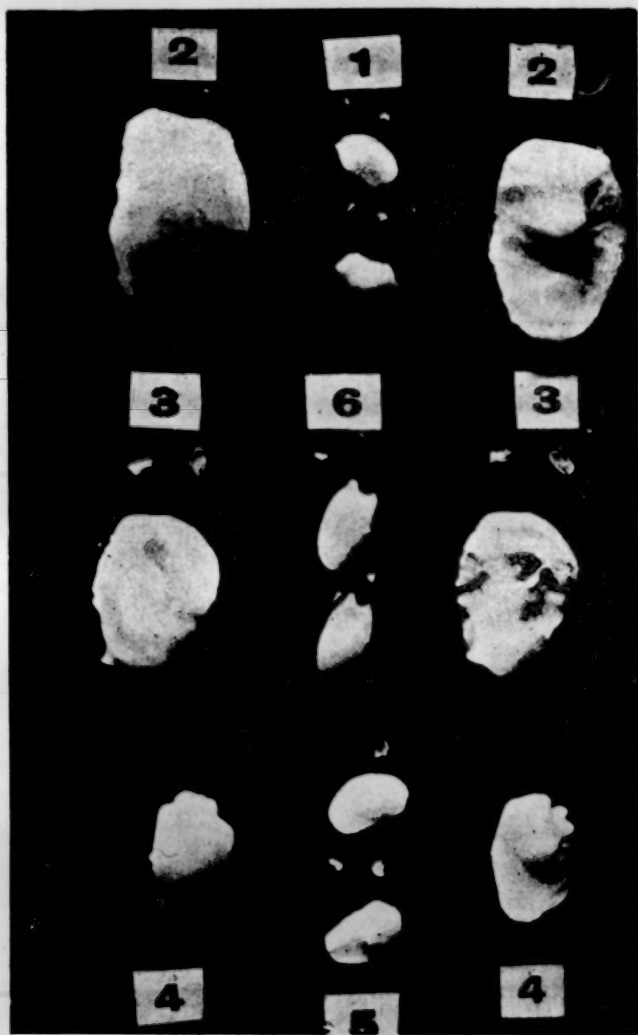


FIG. III.

- |                                      |                                 |                                 |
|--------------------------------------|---------------------------------|---------------------------------|
| 1. <i>SCIÆNA MACULATA</i> .          | 2. <i>S. AQUILA</i> .           | 3. <i>MICROPOGON FURNIERI</i> . |
| 4. <i>PLAGIOSCION SURINAMENSIS</i> . | 5. <i>OTOLITHUS MACULATUS</i> . |                                 |
| 6. <i>NEBRIS MICRIPS</i> .           |                                 |                                 |

which has two small projections, a curious example in sagittæ, downwards (fig. III., 6). (Shown reversed to bring out these projections.) There is no defined lagena, the asterisci being

enclosed with the sagittæ but at the lower end of the sacculus. In *Ancylodon jaculidens* (the "Weak Fish" of Demerara) the decided swelling of the basi-occiput at its forward end becomes almost hemispherical. The sagitta is large. In *Sciæna amazonica*, a South American fish, the position of the sacculus from the outside is easily located. Many of the Sciænoid fishes have an excrescence on the concave side of the sagitta which is notable in *S. aquila* (fig. III., 2). In others the excrescence is formed of granules. This can be seen in fig. III., 1, 3, 4, and 5; in No. 6 the granules are on the stone, but too faint to show in the photograph. The "sulcus acousticus" in these fish also takes a peculiar curved right angle bend; this can be faintly traced in fig. III., 1, 4, and 6.

#### SPARIDÆ.

In this family the sacculus is enclosed in a bony pocket, which has to be cut away to free the sagitta and asteriscus. In *Pagellus centrodontus* (the Sea Bream) the lagena is a broad prolongation of the sacculus. In *Oblata melanura*, a Mediterranean fish, the bone under the sagittæ is thin and semi-transparent.

#### MULLIDÆ.

In *Mullus surmulletus* (the Surmullet) (Couch), although the sacculus is in a pocket open at the top, a great deal of bone has to be cut away to free it completely.

#### CAPROIDÆ.

*Capros aper* (the "Boar Fish") has the sacculus in an open recess; the whole can be lifted out without cutting away any bone.

#### CHÆTODONTIDÆ.

In *Heniochus macrolepidotus*, an Indian Ocean fish, the sacculus is embedded in a bony pocket, which has to be extensively cut away to release its contents. The sagitta is a fair size.

#### OSPROMENIDÆ.

*Osphromenus olfax* (the "Gourami"), a fish from Java, has the site of the sacculus marked by two prominent bulbous swellings of the basi-occiput bone that project even into the cavity occupied by the superbranchial organ that this fish has, it

being one of the *Labyrinthici*. The sacculus is enclosed in a bony pocket that requires considerable cutting away to get it out. The sagittæ are large for the size of the fish (fig. I., 3).

#### EMBIOTOCIDÆ.

The sagittæ in this family are underlaid by thin bone that allows of their site being seen. They are large for the size of the fish. The anterior end is free of bony covering, but the posterior end goes back into a bony cavity that requires opening up to free the lagena end of the sacculus. Of four specimens examined, two came from Japan and two from the west coast of the United States of America: *Neoditrema ransonnettii* and *Ditrema temminckii* from the former country, and *Cymatogaster aggregatus* and *Hysterocarpus traski* from the latter.

#### CICHLIDÆ.

In *Cichlosoma bimaculatum* (the "Patwa" of Demerara) and in *Crenicichla saxatilis* (called the "Sun Fish" at Demerara) there is no external indication of the site of the otoliths; the sacculus is embedded in a bony pocket, but requires only a little cutting out. In *Tilapia nilotica*, a Nile fish, the sagitta is large and much curved; the sacculus required to be cut out.

#### LABRIDÆ.

In *Labrus maculatus*\* (the Ballan Wrass) and in *L. mixtus* (the "Cook") there is no external evidence of the site of the sacculi. From the inside the sacculus can be easily lifted out from the shallow recess in which it lies. The sagitta is deeply notched on both sides, so much so as to require tender handling to prevent it splitting up longitudinally.

#### CARANGIDÆ.

*Caranx trachurus* (the "Scad," also called the "Horse Mackerel") has a well-defined bony pocket for its sacculus open along the top for a short distance. At its lower end this pocket has a constriction in it, but again expands to form a special cavity for the lagena, which is well defined and contains a fairly large asteriscus; the sagitta† also is a fair size. *Lichia amia*, a Mediterranean fish, has the sacculus in a long, trough-like,

\* See 'Zoologist,' 1910, p. 293, pl. I., 12.

† *Ibid.*, pl. I., 7.



bony pocket open at the top; the lagena is a long protruding continuation of the sacculus holding a fairly large asteriscus. *Seriola dummerilii* (one of the "Yellow Tails") and *Temnodon saltator* (the "Skipjack") require the bony pocket to be cut away to get out the sacculus.

#### SCOMBRIDÆ.

This family have small sagittæ for the size of the fishes. In *Sarda mediterraneus*\* (the "Pelamid") (Couch) the pocket for the sacculus is small, it inclines upwards, and is embedded in bone with a small opening at the top. It is situated well in the posterior part of the skull. From *Auxis rocheii*,\* the sacculus could be extracted through the opening at the top without any cutting away. In *Cybius commersonii*, an Indian fish, the sacculus has to be cut out. In *Scomber scombrus* (the Mackerel) there is no external indication of the position of the sacculus; although lying in a pocket, it is not much enclosed by bone; it is visible through the opening at the top.

#### BRAMIDÆ.

*Brama raii* has a long pocket for the sacculus, allowing this to be moved backwards and forwards in it. The sagitta is comparatively small.†

#### ZEIIDÆ.

*Zeus faber* (the John Dory) has its sacculus lying openly on the floor of the brain cavity, it can be picked up with a forceps without further trouble. The sagitta is small and most peculiarly shaped (fig. II., 4).

#### PLEURONECTIDÆ.

Many of this family show the sites of the sacculi very plainly to the external view by a slight excrescence of the basi-occiput, the thin bone allowing the sagittæ to be seen. Owing to the distortion of the head in this family, the sagittæ seem to lie one above the other instead of side by side. In *Psetta maxima* (the Turbot) and *P. laevis* (the Brill) the sacculus is contained in a bony pocket. The latter fish and *Pleuronectes limanda* (the Dab) show the site of the sacculus through thin bone. *P. platessa* (the Plaice) shows the rings of growth of the sagitta from which the age of the fish is deduced most clearly when it is first taken out of a fresh head.

\* See 'Zoologist,' 1910, p. 293, pl. I., 1 and 2. † *Ibid.*, pl. I., 3.

## GOBIIDÆ.

In this family the sacculus is placed in a recess away to the outer side of the skull and rather high up. The sagitta is large considering the usually small size of the fish. In *Gobius joso* and *Periophthalmus koelreuteri* the sagitta can be seen, the bone being thin.

## SCORPÆNIDÆ.

*Sebastes imperialis*, a Mediterranean fish, has a skull that, in the part underlying the sagittæ, is transparent, and the stones are visible as they lie in the head. The sagitta is embedded in bone all round but open at the top; the bone has to be cut away to free the sacculus and its contents. The otoliths of *S. norvegicus* (the Bergylt) (Couch) are fairly large.\*

## COTTIDÆ.

The site of the sacculi in "*Cottus bulbalis*" (the "Bullhead," in Cornwall it is called "Stingdom") is shown by two small swellings of thin bone.

## TRIGLIDÆ.

In *Trigla lyra* (the "Piper") the sacculus lies in a recess so open at the top that the sacculus can be lifted out. It is the same with *T. gurnardus* (the Gurnard); there is no external evidence of the actual location of the otoliths.

## DACTYLOPTERIDÆ.

The sacculus in *Dactylopterus volitans* (the "Flying Gurnard") lies openly on the base of the skull, there being no special cavity for it.

## TRACHINIDÆ.

*Trachinus vipera* (the "Lesser Weever") shows the position of the sacculus exteriorly by two bulbous excrescences of the basi-occiput, which diverge very much at the anterior ends. The sagitta is confined at both ends, although the pocket is open at the top. The stone is of moderate size.

## NOTOTHENIIDÆ.

In *Trematomus hansonii*, a fish brought from the waters of Victoria Land in the Antarctic, two prominent excrescences of

\* See 'Zoologist,' 1910, p. 293, pl. i., 10.

thin bone jutting out to the right and left of the basi-occiput give the location of the sacculi, the sagitta showing through. The sacculus is in a pocket open at the top, through which it could be lifted out without cutting. The sagitta is of fair size.

#### URANOSCOPIDÆ.

The site of the sacculus in *Uranoscopus scaber*, a Mediterranean fish, is shown by a large swelling externally. The sacculus lies in an open depression, the lagena end extending into a pocket of its own.

#### CALLIONYMIDÆ.

In *Callionymus lyra* (the "Skulpin") the sacculus lies openly on the floor of the cranial cavity; no special depression exists for it.

#### BLENNIIDÆ.

There is no external evidence of the situation of the otoliths in *Anarrhichas lupus*, the largest British representative of this family, and known to fishermen as the "Cat Fish." The sacculus lies in a shallow open depression: the whole sacculus was lifted out without difficulty. It was the same in a specimen of *Blennius ocellaris* (the "Butterfly Blenny"). The sagittæ in this family are small.

#### BATRACHIDÆ.

The basi-occiput in *Batrachus surinamensis* (the "Pacuma" of Demerara) shows a large bulbous swelling under the site of the sacculus quite incommensurate with the size of the sagitta when this is got out. The sacculus lies in an open depression; the lagena is attached not at the extremity of the sacculus, but placed about a quarter of the length of the sacculus from the posterior end.

#### ZOARCIDÆ.

The sacculus lies in an open cavity, from which it could be picked out entire in *Zoarces viviparus* (the "Eel Pout").

#### OPHIIDIIDÆ.

The bone of *Ophidium barbatum* is very thin where it lies under the sagittæ, which are plainly visible through it; they are large and solid. The angle they make with the middle line of the skull is very distinct.

## LOPHIIDÆ.

In *Lophius budegassa*, a Mediterranean species of the "Angler" family, the sacculus rests in a shallow flat depression.

## ANTENNARIIDÆ.

*Antennarius hispidus*, from the Indian Ocean, shows the position of the sacculi under the base of the skull by the bone under the pockets standing out in divergent sections.

## BALISTIDÆ.

The sacculus in *Balistes capriscus* (the "File Fish," also called the "Trigger Fish") lies in a pocket open at the top, through which it could be lifted out. The sagittæ are small (fig. II., 10). *B. niger* is similar.

## TETRODONTIDÆ.

In *Tetrodon leopardus*, a "Globe Fish" of the Indian Ocean, the ear membranes lie in a cavity at the side of the skull away from the middle line and at the posterior end of the brain cavity.

## MOLIDÆ.

*Orthogoriscus mola* has no otoliths; it is supplied with otoconie only,\* in this respect resembling the cartilaginous fishes.

When dissecting for otoliths one is occasionally met with a difficulty in finding one, or sometimes both, of the particular stones; e.g., one lapillus, or asteriscus, or perhaps both asterisci. At first want of skill may be held to be responsible for the non-success, but as skill improves and experience shows that even fairly large stones are missed, it begins to be surmised that perhaps the stones in these cases are non-existent, and have never been developed. To quote some cases; eight different species of the *Lutjanus* family were examined, and in one case the left asteriscus could not be found; the note made at the time reads, "The left asteriscus missed, the sacculus and lagena were got out entire, and the most careful search was made, but not a vestige could be found." In all the other cases both, and in this

\* See article by Professor D'Arcy W. Thompson, "On the Auditory Labyrinth of *Orthogoriscus*." 'Anatomischer Anzeiger,' iii., Jahrgang, Nos. 4 and 5, 1888.



particular fish, the right asteriscus having been recovered, it only leaves the surmise that in this instance there was no left asteriscus. In a *Platax vespertilio*, one of the *Chætodontidæ* of the Indian Ocean, no lapilli could be found, although careful search was made. The lapillus, as a rule, is very easily got, and in four allied genera they were got; it would seem that in this particular *Platax* they may have been wanting. In a *Lopholatilus chamæleonticeps* that was most carefully dissected, the sacculi were got out whole; the lagena of each showed as a distinct little purse, but on searching them no asteriscus could be found in either. There were two observers on this occasion, and had there been an asteriscus in either lagena it could not have escaped observation. In a *Brosmius brosme* examined, one lapillus, that on the left side, could not be found, the tissues came out whole, the "recessus utriculi" with the sacculus, and most careful search was made; to judge by the right lapillus, it is a fair size, and could hardly have been overlooked in the careful search made. In two of the *Characinidæ*, a *Hydrocyon brevis* and an *Alestes nurse*, the rod-like sagitta was wanting in the first on the left side, and in the second on the right side. In each case the sacculus was got out whole, but no trace of the sagitta could be found; the same care was exercised that resulted in the sagitta being found on the opposite side in each case. In a former paper ('Zoologist,' 1910) a note was made pointing out that three cases of abnormal sagittæ had been come across; in these the abnormality consisted in the difference of the structure of the stones to what is usually the case, it would therefore perhaps not be assuming too much to surmise that the abnormal might be also met with in the guise of an otolith being wholly wanting. More evidence is, however, requisite in this matter, and it would be of interest if others who have made researches in otoliths would publish their experiences on the subject. In this connection it is interesting to note that Couch, in his 'Fishes of the British Islands,' vol. iv., in the article on the Carp, has as follows:—"Nor is this the only remarkable irregularity of structure, for I am informed by Edmund T. Higgins, Esq., who has carefully studied these objects in various orders of fishes, that in the Carp the otoliths (bones of the ear) are not always alike on both sides; in fact, that in some in-

stances they are altogether wanting on one side. The position of these bones is also different from what is the case in other fishes, so that the bone termed the *malleus* is at a distance from another called the *incus*, and it is serrated all round the border." Mr. Higgins is right when he says the position of these bones ("stones," he should have called them) is different from what is the case in other fishes, for the asteriscus is so much more completely embedded in a bony cavity, as mentioned *ante*; it is the largest of the otoliths in this fish, and so came under observation, the small rod-like sagitta being overlooked. The *malleus*, as he calls it, is evidently the asteriscus as at present named; as he says, it has a serrated edge all round (see the illustrations in the article on the "Asteriscus in Fishes" in the 'Zoologist,' 1910). The *incus* of Mr. Higgins is the lapillus, which, as he describes it, is at a distance from the *malleus* (asteriscus). Presumably Mr. Higgins was dealing only with British fishes, and so did not come across specimens of the *Characinidæ*, when he would probably have recognized the resemblance in their case to Carps. His evidence as to the occasional absence of the otolith in the Carp is noteworthy. A converse case to the absence of an otolith was met with once in a *Lenciscus dobula* (the Dace), the "recessus utriculi" on the right side of the head held two lapilli, whilst that on the left side held the normal one lapillus. In this case, three lapilli having been found precludes any idea that by some chance the one from the left side had got mixed up with that on the right side, and so account for the two on this side.

This paper cannot be concluded without recording, with many thanks, the obligation the writer is under to many institutions and personal friends for specimens received of fishes described; and in particular his indebtedness to Mr. R. H. Burne, of the Royal College of Surgeons, for much help, always most kindly given, in dissecting heads, and but for whose help much of the interest of this article would have been wanting.

## NOTES AND QUERIES.

## MAMMALIA.

**The Water-Shrew (*Neomys fodiens bicolor*) in Worcestershire.**—Whether this melanistic form of the Water Shrew is proportionately distributed in Great Britain or more or less local is not as yet known. In this neighbourhood it is certainly rare, and only in one instance, at Wribbenhall on December 25th last, have I been able to obtain a specimen.—J. STEELE ELLIOTT (Dowles Manor, Shropshire).

## AVES.

**The Thrush's Song.**—The facility with which some birds incorporate the notes of other species in their song is well known, and our common Song-Thrush (*Turdus musicus*) is as apt an imitator in this way as most of them. A rather curious, and I think unusual, instance of the kind may at present (March) be heard here, and it suggests enquiry as to how the habit may be acquired. We have in this neighbourhood, at 1000 ft. about the sea, comparatively few small birds resident during winter, not more than an odd pair or two of Thrushes remaining; the significance of this becomes apparent below. The male of the only pair of Thrushes resident in our garden started singing on February 4th—an ordinary song. Since that date several others have appeared and sung every fine morning. One of these constantly makes use of the triple call of a Redshank (a by no means singular occurrence), occasionally one reproduces a note or two borrowed from the Curlew. Just a week ago, one began giving such a perfect imitation of a Wood-Lark's song that, though it was practically impossible for the latter bird to be here, I was obliged to go into the plantation before I could really convince myself on the point. On most fine days the song is frequently repeated at intervals, in the ordinary Thrush's song, but it is gradually losing its perfection. Now, the curious thing is that we never have any Wood-Larks in this part of the country (rare accidental visitors, of course, excepted), and one wonders how the Thrush has picked the song up, and where? It is pretty certain that it is not a resident Thrush, and quite certain that it has never heard the Wood-Lark's song here. Can it have

lately come from a district where that song was familiar just now? It may be added that it is only occasionally that a Redshank is to be heard here, but Thrushes might pick up the notes of that bird not so very many miles away.—GEORGE BOLAM (Alston, Cumberland).

**Visitation of Black Redstarts (*Ruticilla titys*).**—It is well known that the Black Redstart is a regular visitor to certain parts of this country. This winter, however, I am inclined to think that the species has visited us in greater numbers than usual. This is especially obvious in the case of Northumberland, where previously there have only been six recorded.

*Northumberland.*—Holy Island, November 5th, 1913; adult male ('British Birds'). Chopwell, November, 1913; adult male. "Feeding on green fly," P. Charlton. Woodhorn, Ashington, November, 1913; adult male, T. Robinson ('Newcastle Weekly Chronicle'). Cullercoats, December 26th, 1913; female. Cullercoats, February 10th, 1914; immature. The last two birds were both moving south in a leisurely fashion along the shore.

*Cumberland.*—Workington, December 21st, 1913; adult male, John Wilson ('Carlisle Journal').

*Lincolnshire.*—North-east coast, October 13th, 1913; rarely met with in this county. Four previous records ('British Birds').

*Somerset.*—Taunton, October 9th, 1913 ('Field').

*Norfolk.*—Norwich, December, 1913; adult female ('Canary and Cage Bird Life').

*Wales.*—Llandudno, January 10th, 1914, T. A. C. Valley, January 14th, 1914, T. A. C. ('Manchester Guardian'). It would be interesting to hear if this species has occurred in other localities where it is usually rare.—J. M. CHARLTON (Brampton, Cumberland).

**Redbreasts' Nest in a Tree.**—A pair of Redbreasts in Waterlow Park, Highgate, commenced on March 4th building a nest in a hole in the trunk of a tree nearly 10 ft. from the ground, a rather unusual site.—H. KIRKE SWANN (Finchley).

**Notes on the Nightingale (*Daulias luscini*).**—The Nightingale, which had been falling off to a marked degree for ten years or more, last year (1913) visited this district in something approaching its former numbers and, to my astonishment, one pair nested and successfully reared a brood in our garden. I had begun to think that we were not going to have any Nightingales at all, as I neither heard nor saw one until April 24th, which was the date upon which our bird was first noted by me—it was singing at the further corner of



the back garden at 9 a.m. A Lesser Whitethroat, which I had been waiting for, evidently arrived at the same time, and this bird, too, finally mated, and a brood was reared on our premises. The Nightingale was mostly singing all day, from the 24th to the 28th, yet it was not until the latter date that it began to sing at night, when it commenced some time before 10 p.m., and this night-song continued until May 6th, when I detected the arrival of a female, and from that time it ceased. The song usually commenced at about 9.45 p.m., and must have continued throughout the night—the bird would be singing at midnight, I heard it whenever awake, and it would still be singing at daybreak. Rain stopped it at once—the night of the 3rd was wet and gloomy, and except for one or two outbursts at 10 p.m., the bird was silent, and the following night, although singing with great vigour, it instantly ceased on rain commencing to fall at midnight. I first discovered the presence of a female at 2 p.m. on May 6th, and believe she had but just arrived, and from that time, except for an occasional attempt at about 10 p.m., the night song ceased, although another Nightingale was singing at a distance of little over two hundred yards away. It was the male who selected the spot, and he seemed determined that no alteration should be made, if I may judge by his conduct when in the presence of the female, and accordingly she commenced to build on the morning of May 9th, and the nest was finished and contained one egg on the 15th. As far as I know, the female did all the building, and she appeared to work until 9 a.m., or a little later, and then left off for the day. The nest, constructed of the usual dead oak leaves, &c., was built upon some bundles of old pea-boughs which had been stacked against a laurel hedge, preparatory to being burned, and was at a height of 3ft. above the ground. Sitting commenced May 19th on five eggs, a duty apparently undertaken only by the female, and she was removing the egg-shells on the evening of June 2nd, the young leaving the nest on the 14th of that month. I expected to be able to see something of these young birds after leaving the nest, but it was only with great difficulty that anything could be seen of them; I do not think more than one at a time was ever seen by me, though they must have often been quite near me in the garden. With the parent birds, however, it was very different—they were more tame and confiding than the familiar Robin—but the presence of a cat was instantly detected, and they never left it all the time it remained anywhere near the nest or young. The young birds made more noise while being fed in the nest than I supposed would be the case.

The male had practically ceased singing by June 9th, though I did hear it for a moment on the 13th.—ROBERT MORRIS (Uckfield, Sussex).

**Status of Blackcap, Garden-Warbler, and Lesser Whitethroat.—Bedfordshire.**—Throughout the whole of the county the Garden Warbler outnumbers the Blackcap by about two pairs to one, and the Lesser Whitethroat is about as common as the latter species.

**Shropshire.**—I can only speak from personal experience of the neighbourhood in which I live, and here the Garden-Warbler is even commoner, numbering probably three pairs to one, the Lesser Whitethroat again being about equal to the Blackcap. The distribution of our breeding birds in the British Islands is as yet very imperfectly known, and it would be of very considerable scientific value if a complete record, showing this distribution by means of shaded maps in colour or otherwise, could be published.—J. STEELE ELLIOTT (Dowles Manor, Shropshire).

**Waxwing in Suffolk.**—A hen Waxwing (*Ampelis garrulus*) was picked up dead at Beyton on January 21st, and brought to me in the flesh. It had certainly been shot at, but was in very good condition when found, and is now in the Ipswich Museum.—JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds, Suffolk).

**The Little Owl Breeding in Somerset.**—I see a note in the 'Zoologist' (*ante*, p. 112) from Mr. Sanley Lewis, of Wells, Somerset, on the subject of the Little Owl (*Athene noctua*) breeding in Somerset. This is not, as he thinks, the first discovery of its breeding in this county. The Little Owls have nested here close to my house for the last four years, to my certain knowledge, and possibly longer. So far they do not appear to have developed any excessively predatory habits amongst young game in this part of the country. The nests always contain a plentiful supply of young rats and mice, and I have once found a Thrush.—H. L. POPHAM (Hunstrete House, Pensford, near Bristol).

**Gannet Choked by a Gurnard.**—I am indebted to Mr. John Renwick for a rather curious photograph of a defunct Gannet, which was taken by one of a geological party (Mr. N. G. Reid) on the shore at Turnberry, in Ayrshire. The dead bird had met its death in a way which, I was told when at Ailsa Craig, has happened on previous occasions, *viz.* in trying to swallow a Gurnard (*Trigla* ?), whose spinous dorsal fin had become wedged in its throat, with the result that the Gannet, unable either to swallow the fish or get rid of it, was starved. The Gurnard is a very common fish in British seas,

and Gannets certainly do prey upon small ones with impunity, but in this case a larger one than usual had been captured, judging from the part of it which is still visible in the bird's open mouth. It appears that other birds besides Gannets have met with a similar



fate, for in the 'Zoologist' for 1894 (p. 265) there is an account of a Great Northern Diver being choked by a Gurnard, and on p. 308 of a Cormorant which was choked by a Flounder.—J. H. GURNEY (Keswick Hall, Norfolk).

**Hybrid Ducks.**—Referring to the three Pochard and Sheld-Duck hybrids (*ante*, p. 76) at Christchurch Park, Ipswich, I saw them again on March 4th. They are, I should say, a drake and two ducks, and will probably be the only ones bred, as the Sheld-Duck appears this year to have paired with a drake of her own species. It was rather interesting to watch them on the water, the Pochard keeping near the other two, but at a respectful distance, while his old mate seemed entirely to ignore him, and to be quite happy with her partner. — JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds, Suffolk).

**Early Arrival of the Stone Curlew.**—On the night of March 11th, on which occasion the moon was very bright, the moat close to my daughter's home at Rougham was visited by a bird which could only have been a Stone Curlew (*Edicnemus scolopax*). The note was

described to me as exactly like "the Great Plover's human whistle" mentioned by Tennyson, and I was also told that the Dabchicks, which have now returned to the moat, seemed from their calls to be much disturbed by the unusual sounds. It is an early date for the Stone Curlew; I have a note of one which I handled in the flesh at Bury on March 25th, 1899. — JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds, Suffolk).

**Avicultural Notes.**—I have been asked by a well-known ornithologist to write an account of my tame Swift (*Cypselus apus*). I found the little creature last summer on June 30th, when passing through the village of Bircher, about five miles from the town of Leominster, where I live. It had fallen from its nest, and was making strenuous efforts to climb up the wall of the house back to it, for the nest was under the eaves just above where the little creature was struggling on the ground. The old birds were screaming joyously overhead, appearing to know nothing about it.

The little Swift was about two inches long, its colour was grey, the quills were just beginning to appear, and even at that early age the last joint of the wings took an upward curve. It appeared to be strong and healthy. I placed it under a clump of weeds near by in the shade, as it was a very hot day. I was spending several hours on the common a mile further on, and finding it still there on my return in the evening, I took it home with me. For the first four or five days I fed it every half hour on small quantities of blight. For the next month I fed it on mountain bread, the food used for young canaries, but it did not thrive at all well on it. It hardly grew at all, and the development of the feathers was very poor; its body was covered at the end of a month but very thinly, and the wings were covered with short feathers. At the end of July I went to stay on Bircher Common for ten weeks, and took the bird with me. At this time I began to feed it on wasp grubs; these it liked very much. I led an outdoor life and took my little Swift everywhere.

It developed very quickly under these conditions; the wings grew very long and strong, and appeared to be quite normal, but for some reason or other it has never used its wings for sustained flight except on one occasion. I had left it upstairs, and while sitting at breakfast, suddenly heard a flutter of wings and the little Swift alighted at my feet, passing on its way an open window and door. I only kept it in confinement when necessary for its safety. While staying on the common I used to hang its basket on the garden fence, when it would climb about and retire to its basket again of its own



accord. We picnicked out a great deal, sometimes walking for miles, and the Swift always came with us, and when putting up sandwiches, I had always to remember a piece of wasp-comb. I once put its basket down in the fern some distance from where we were sitting, thinking it was securely fastened; two hours later, when I went to it, I found it hanging in the fern. It was at this time fully fledged. Another day, when at the highest point of the common from which an extensive valley slopes, I threw it up in the air, but it only fluttered down into the fern and made no attempt to fly away. I carried it with me on bicycle rides very often, hanging its basket on the handle-bars; on one occasion it accompanied me on a ride of twenty-six miles. At first it showed restlessness but very quickly became accustomed to it, and would settle down at the bottom of its basket as soon as it was hung on the bicycle, not moving till the end of the ride, when it would begin to chirp and climb up the side of the basket. I thought this showed great intelligence; also it would attract my attention when shut in its basket, if hungry or thirsty.

It takes very little water, and takes it from my mouth; it has a queer little habit of shaking itself in anticipation as I take the water into my mouth; it generally sits on my hand both to eat and drink. At the end of September the wasp grubs came to an end—from then till the present time I have fed it on meat maggots. I give it thirty for a meal every two hours, killing them first by snipping off the heads with a pair of scissors. I once tried to see how many it would eat; when it reached fifty I left off, but the bird would have eaten more. I find thirty are as many as it can digest well. It takes them from the end of my finger, but never attempts to help itself, even when the food is close under its beak, it seems not to recognize it. It takes exercise by beating the air with its wings while holding tightly to the edge of its basket with its claws. The legs appear to be very weak. I have never seen it walking without at the same time flapping its wings; in this way it gets over the ground very quickly. It very much objects to being on the ground, and will very quickly climb up my dress till its head is under my chin; there it will hang for hours, nibbling occasionally at my throat, and no occupation or position will dislodge it. As an adult bird it is very silent; it has only two cries—one a kind of scream which it utters with its mouth very wide open to show annoyance, the other is a monotonous shrill chirp, very much like the song of the cricket; this cry it kept up continually when young, often through the night as well. On one

occasion the Swift was hanging on the outside of its basket near the fire, and the warmer it became the louder grew its song, when a Toad walked in, evidently attracted by the song and expecting a meal. The Swift is extremely sensitive to cold, and for this reason I found it impossible to keep it in a cage. I did try it, but it wandered aimlessly about and seemed very unhappy. Then I tried putting flannel in the bottom of the cage; it immediately burrowed under the flannel, so this quite decided me. I have kept it in quite a small basket, the lid of which is generally open; it never attempts to come out except when it is time to be fed; it can gauge the two hours as accurately as I can, then it will come on to the edge of the basket and look at me. A weird little object it looks, with its large deep eyes. If I do not notice it, it will begin to flap its wings, and if that does not gain attention, it will flutter to the floor. I place flannel in the basket, and also cover it with flannel, and I keep a hot-water bottle underneath, well wrapped up to allow a little heat to filter through. One of its happiest moments is when the bottle has been newly filled; it spreads itself out on the flannel, almost like a bird taking a sun-bath. It sleeps with its neck and head flat on the flannel and never behind its wing. It has a very good digestion, and has never cast up any pellets. It is apparently healthy and in good condition, and, I think, quite happy.

It moulted slightly all through the winter, and in the second week in January it shed in one night all the feathers from head and neck, and a thin line on each side of the breastbone; in about three days the new quills appeared, and the plumage developed in about a fortnight, much stronger and healthier than the first growth. I did not notice any signs of migratory restlessness; at the time the Swifts were leaving I left it out of doors constantly that it might go if it wished. It plumes itself a great deal, but I have seen no inclination to bathe.

In its habits the Swift is quite unlike the ordinary cage bird; it enjoys being caressed and handled, it will close its eyes while being stroked, and flutter its wings and at the same time utter its faint little chirp in a most fascinating manner. It comes into my bed every morning, and if I do not wake when it is ready to come, it will utter its cry of annoyance; as soon as the lid of the basket is opened it will flutter on to my shoulders and creep into my neck, wedging itself tightly between my neck and the pillow; when it has enjoyed this position for a short time, it will come out and nibble my face for something to eat, and after it is satisfied, will retire with great speed

back to its position under my neck.—ROSAMOND S. TWYMAN (Sunnyhurst, Leominster).

## VERMES.

Notes on a Small Collection of Earthworms (Lumbricidæ) from the Island of Islay.—So little has been done among the Earthworms of Scotland that I should like to add a few records to the Rev. Hilderic Friend's paper on the "Distribution of British Annelids" ('Zoologist,' 1913, p. 262). Hearing that no Earthworms had, apparently, ever been collected in Islay, I made a collection when I was in the island in August, 1913. The summer was an exceedingly dry one, and worms were difficult to find. Mr. Friend was good enough to identify my specimens as follows:—

1. *Dendrobæna subrubicunda*, Eisen.—The Gilt-tail.
2. *Allolobophora longa*, Ude.—This species is widely distributed in Scotland.
3. *A. caliginosa*, Sav.
4. *Aporrectodea chlorotica*, Sav.—A common worm in Scotland.
5. *Octolasion studiosum*, Rosa (= *O. cyaneum*, Sav.).—Local.
6. *Lumbricus rubellus*, Hoffmeister.—Generally distributed in Scotland.
7. *L. castaneus*, Sav.—Plentiful on mainland.
8. *L. terrestris*, Linn.—One of the commonest and most generally distributed.

It will be seen that there are no rarities in the list; but island faunas are always of interest, and possibly, in a more favourable season, several species might be added. They are all widely distributed forms which have been reported from the Scotch mainland. The Brandling (*Eisenia fatida*, Sav.) is, however, not among them, and I am almost certain that I have seen it in manure-heaps on other occasions when I was in Islay.—HAROLD RUSSELL (16, Beaufort Gardens, S.W.).

## CUMBERLAND NATURE RESERVE ASSOCIATION.

Some of the many readers of the 'Zoologist' may perhaps be interested to know that a Cumberland Nature Reserve Association has been recently formed, with the Right Hon. J. W. Lowther, Speaker of the House of Commons, as President, the Mayor of Carlisle, Major S. C. Ferguson, as Chairman, and Mr. L. E. Hope, Curator of the Carlisle Museum, as Hon. Secretary. The objects of the Association are twofold: the promotion of Nature Reserves in Cumberland, and the institution of a Watcher's Fund for providing protection to plant and animal life

in the county, particularly to those of the rarer birds requiring special protection during nesting. Already one Nature Reserve has been established in affiliation with the Association, namely, on Kingmoor Common and adjacent wood, near Carlisle, where nesting-boxes have been fixed and drinking ponds prepared. A list of the fauna and flora of the Reserve is to be prepared this year, and it will be interesting to see what beneficial effect the protection has. At one time this common was a favourite breeding ground for the small summer visitors, and also one of the richest grounds in the county for the botanist, but of late years, through having been let for cattle-grazing, it has become very much depleted. An appeal is made to all interested in the preservation of our native fauna, some of which, like the Peregrine Falcon, Buzzard, and Raven, are the special objects of the egg-collectors' greed, and it is hoped sufficient funds will be raised for this purpose. The Association will be glad to receive subscriptions from any of your readers who are interested in the preservation of these birds, and subscribers can, if they wish, have their subscriptions ear-marked for this purpose. — D. LOSH THORPE, M.B.O.U. (Loshville, Carlisle).

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## OBITUARY.

### SIR JOHN MURRAY.

SIR JOHN MURRAY, whose sudden death owing to a motor accident took place on March 16th, will always be remembered as a great contributor to the science of Oceanography. He was born at Coburg, in the province of Ontario, in 1841, and when sixteen years old came to Scotland, and, after a short period spent in the Stirling High School, entered the University of Edinburgh. Here he studied enthusiastically and successfully, but his independent spirit declined to be bound by a systematic curriculum, and he never took a degree. It was, however, his work in Professor Tait's laboratory which led to him being appointed on the scientific staff of H.M.S. 'Challenger,' when in 1872 she started on her memorable cruise round the world. From that time the success of the expedition became his main object in life. He voluntarily undertook the registration, packing and despatch of the enormous collections sent home from the various ports visited by the expedition. These were all consigned to the University of Edinburgh and, except for the purpose of replacing



evaporated spirit, remained untouched until her return in 1877, to unpack them. It is a striking tribute to the care which had been taken that out of many thousands of bottles only four were broken. In 1881 he succeeded Sir Wyville Thomson as editor of the Reports which were just beginning to appear, and for twenty-three years superintended the issue of those fifty ponderous tomes, containing over 29,000 pages and about 3000 lithographed plates, charts, and other illustrations. He contributed himself, in collaboration with the late Abbé Renard, an epoch-making volume on the 'Deep-sea Deposits'—a work which laid the foundations of that branch of science, and which will always be essential to the worker in it, even though he may disagree with some of its conclusions.

Although when this task was finished he initiated other scientific enterprises, he still regarded the 'Challenger' expedition as *the* great work of his life, and recognized this by naming his house and one of his sons after the vessel.

His later works included expeditions in the 'Knight Errant' and 'Triton'; the foundation of marine laboratories at Granton and Millport; a bathymetrical survey of the Scottish Lakes (undertaken in conjunction with his friend, the late Mr. Fred. Pallar); the exploitation of Christmas Island; and an expedition, along with Dr. Johan Hjort, in the Norwegian steamer 'Michael Sars,' the cost of which was borne by Murray himself. Its results were published in a joint work entitled the 'Depths of the Ocean,' in 1912.

It is needless to add that he received degrees and decorations and other distinctions too numerous to mention, but the memory in the hearts of those who knew him and worked with him is that of a man endowed with a deep-seated love of truth and of science for its own sake, and a loyal comrade who unflinchingly, not to say brutally, told his friends just what he thought of them to their faces, and never spoke ill of them behind their backs; of one who, though he might seem unfeeling to the outsider, could always be depended on for sympathy and help in time of need.

W. E. H.

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GEORGE BENTLEY CORBIN.

WE regret to record the loss of another old and valued contributor to the 'Zoologist' in the person of Mr. G. B. Corbin, who passed away on March 12th last, aged seventy-three years. Mr. Corbin was quite a self-made man; he was educated at the National Schools, and this education terminated at an early age, when he was

taught his father's business of a cabinet-maker and upholsterer. He then continued his education at evening classes with considerable success. But he was a true lover of Nature, and his great natural history lore was acquired first-hand in the fields and woods by his gifts of intelligent observation. In this he found the pleasure and purpose of his life.

In 1862 he contributed his first paper to the 'Zoologist,' "The Macro-Lepidoptera of Ringwood, in Hampshire," with a supplementary note by the Rev. Joseph Greene, M.A., and since that time he had been a more or less continuous recorder in our pages. We may recall his paper "On the Occurrence of the Needle-tailed Swift for the second time in England," which was published in 1880, and we are glad to learn from his relatives that this specimen "will eventually be added to the National Collection at South Kensington."

Mr. Corbin had a considerable number of friends and correspondents among eminent naturalists, including Charles Darwin and Charles Kingsley. With the former the subject was "Insectivorous Plants," with the latter the interest was focussed in the proof of the presence of the Smooth Snake in the New Forest. In his declining years he pursued the business of a taxidermist, and we are informed that for over thirty years he was a member of his church choir.

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## NOTICES OF NEW BOOKS.

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*The Life and Habits of the Badger.* By J. FAIRFAX BLAKEBOROUGH and Sir A. E. PEASE, Bart. 'The Foxhound' Offices, Piccadilly.

SOME years ago Sir A. E. Pease published a monograph on the Badger, after its appearing as articles in the 'Yorkshire Post.' Even since that date much more material has been collected and some statements revised, while Mr. Blakeborough, in conjunction with the previous writer, has now produced a thoroughly up-to-date and attractive volume on one of the most interesting members of our mammalian fauna. Few Englishmen, indeed, have seen a Badger in his native haunts, while some of us, in

days now long past, may remember that animal domiciled and captive in certain sporting resorts where "Badger-drawing," so called, was and could be witnessed; a cruel practice, now happily discarded. This book takes us to the creature in its natural haunts and advocates its preservation; may Brock long remain with us despite much ignorant persecution!

As regards the vexed question of mange and its possible dispersion by Badgers and Foxes, the evidence seems to promote a negative conclusion. Brock is a very cleanly animal, and Badgers "may very occasionally become mangy in a country in which the scourge has for long been prevalent among Foxes." Mr. Blakeborough has "no hesitation in saying that Badgers in a hunting country do far more to aid and abet the sport than to spoil it. Man, with his desire to have the credit of preserving Foxes, and still rear a huge breed of Pheasants, with a minimum of danger, has done far more to ruin Foxes and Fox-hunting than ever Brock has or will do. Hand-fed, hand-reared Foxes are the mangy, ring-running brutes so often found nowadays."

As regards the theory of protective colouring as applied to the Badger, some reasonable and qualifying facts are contributed. "If the Badger wears the best coloration for night, why was a Fox made red with a white tag often to his brush instead of white on his face? He also is a nocturnal animal. If a black tail is concealing, a white tail is revealing. The Ratel, similarly coloured in many respects to the Badger, is diurnal as well as nocturnal, so that what is supposed to suit a nocturnal animal has to do duty by daylight too."

The book is well and pleasantly illustrated.

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*Animal Communities in Temperate America, as illustrated in the Chicago Region; a Study in Animal Ecology.* By VICTOR E. SHELFORD, Ph.D. London: The Cambridge University Press.

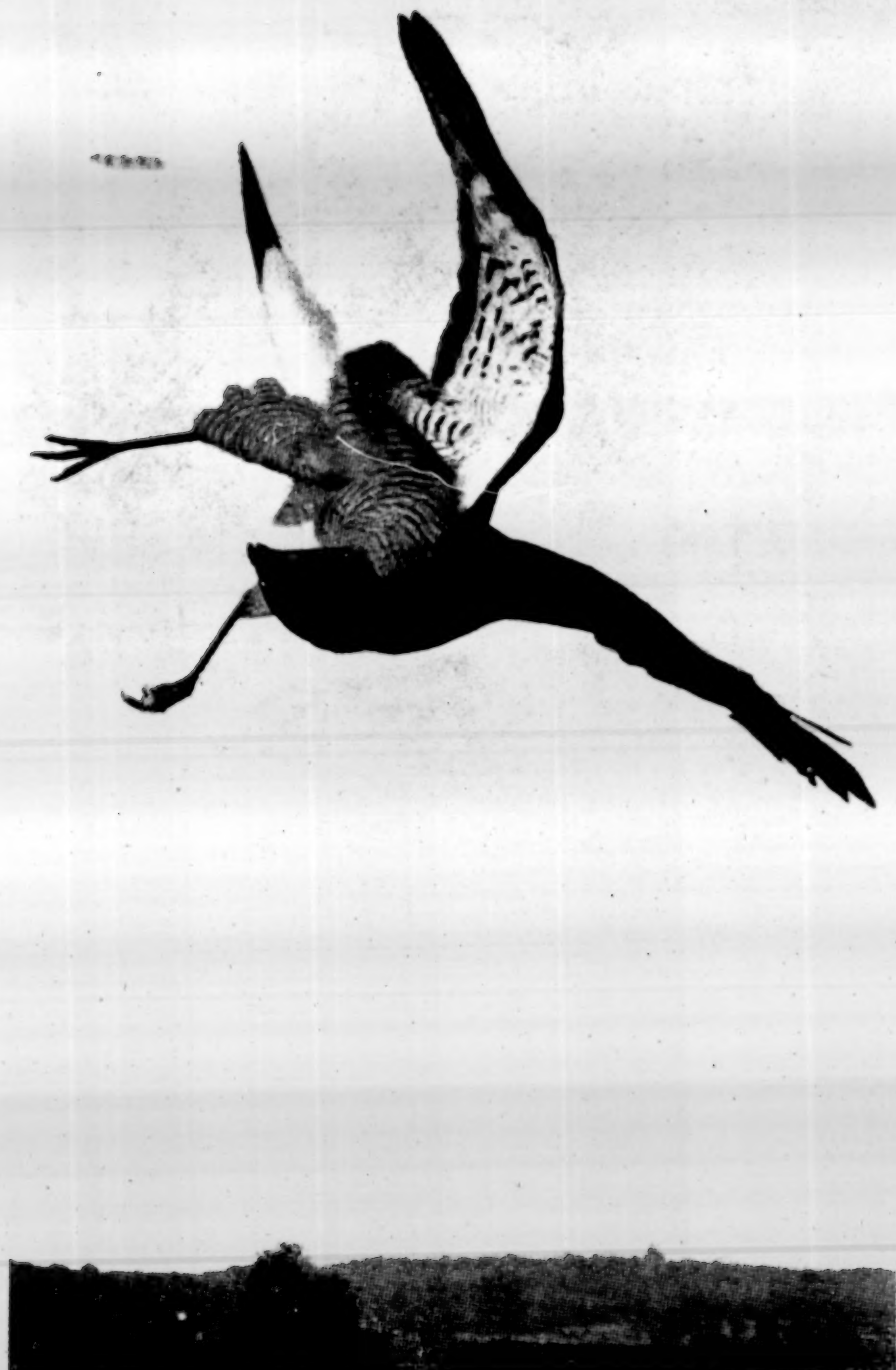
THIS book is the result of a study of the whole animal life of a distinct area in connection with its environment. This is too seldom done. Few naturalists, indeed, are intimately acquainted with the whole fauna attached or incidental to their

private gardens, and equally few have a knowledge of the fauna and its environment in the larger detail of their own neighbourhoods. Dr. Shelford has produced a volume which will not only incite this study but prove a model for that purpose; it is rich in observational information and focusses attention on the environmental causation of many animal communities.

There is a very useful discussion on our methods of animal protection. "Mistaken and sentimental ideas cause the killing of many useful animals and the protection of many noxious ones. The farmer kills Snakes and Skunks whenever he has the opportunity, though they are among the most useful animals." Shrews are frequently killed, though they are destroyers of Mice, as is also the case with the House Centipede, though it is the enemy of household pests, &c. Dr. Shelford is not a theorist, and he does not advocate some very prevalent and popular suggestions. Thus, we read in his summary of mimicry:—"One species of insect (or other animal) resembles another. The theorist finds or thinks one of them is distasteful to birds (or other animals). He further discovers or concludes that the species, not having a bad odor or taste, is not eaten by enemies because it resembles the distasteful species. The species having the bad odor or taste is the model. The species not having the bad odor or taste is the mimic. The mimic arose and attained its perfection because those individuals of the mimic species which resembled the model species survived." The argument is at least clearly stated, though its conclusion is apparently unaccepted, and this is not to be regretted, for a theory may be sound and probable, but liable to be distrusted through extreme advocacy and by the sometime employment of unsifted evidence; opposition thus becomes a tonic.







A SPARROW-HAWK RECEIVING THE CONTENTS OF KEEPER'S GUN.